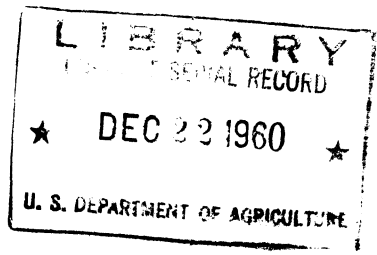
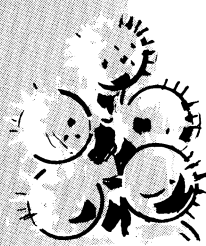


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CASTORBEAN

PRODUCTION



Farmers' Bulletin No. 2041
U.S. DEPARTMENT OF AGRICULTURE

Industrial demand for castor oil in the U.S. has risen steadily since World War II. However, domestic production of castorbeans was economically unattractive after the war and production declined.

Interest in the crop began to revive as improvements in methods of production led to greater castorbean yields.

Complete mechanization, improvement of varieties, and extension of irrigation to practically all the castorbean acreage made possible a fivefold increase per acre in castorbean yields between 1953 and 1958.

In 1958 about 24,000 acres of castorbeans were grown in the U.S. This acreage produced about 20 percent of the castor oil used in this country. The rest of the castor oil was imported.

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CASTORBEAN PRODUCTION

Prepared by Crops Research Division, Agricultural Research Service

Seed of the castorbean plant is the source of castor oil, which has a number of uses in industry.

The greatest single use of castor oil in the U.S. is in the production of a fast-drying oil for the manufacture of paints and varnishes. Castor oil is used also to produce sebacic acid for plastics manufacture. Other uses are in the manufacture of all-purpose greases, hydraulic fluids, artificial leathers, printing inks, and cosmetics, and in the dyeing of fabrics. A small amount of castor oil is used for medicinal purposes.

In Europe, a chemical process has been developed that uses modified castor oil for the manufacture of synthetic textiles and soft and hard plastics.

Castorbean pomace, the residue from oil extraction, is used for fertilizer.

PLANT DESCRIPTION

In the tropics or subtropics the castorbean plant is a perennial. In temperate regions, however, the plant is an annual. Commercial types of castorbean plants grown in the U.S. are 3 to 12 feet tall.

The plant consists of a series of stems or branches, each terminated by a spike. With row-crop spacing—one plant in about 3 square feet—the plant contains two or three branches that originate at the nodes just below the first spike.

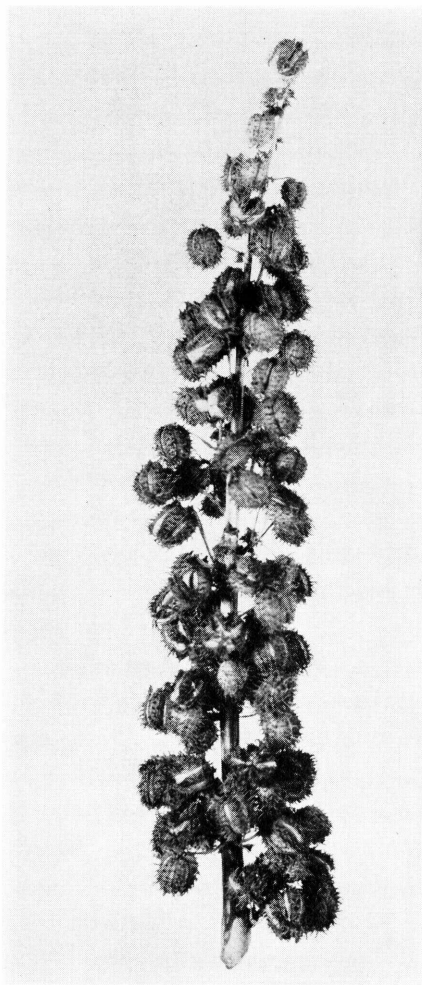
The flowers are of two types—male and female. The female flowers may be on the upper part of the spike (raceme) and the male flowers on the lower part, or the male and female flowers may be interspersed along the entire spike. In some varieties of castorbeans some of the plants contain

MARKETING CONTRACTS

Castorbean production in the United States is an integrated industry. Farmers grow castorbeans under contract with castor oil processors.

The processors agree to pay a definite price at harvest. They sell seed, give specific information on growing the crop, and help make arrangements to harvest it.

Do not grow a castorbean crop unless you have a marketing contract with a processor.



BN-10472

Mature spike from a commercial hybrid castorbean plant. The spike is about 16 inches long.

spikes with only female flowers. This has made possible the production of hybrid seed.

The lowest spike on the castorbean plant is the first to mature. At the end of the growing season, the lowest spikes may be fully mature while the upper spikes are just beginning to flower.

The mature spike usually is 6 to 12 inches long and bears from 15 to more than 80 capsules. The length of spike

and number of capsules depend on the variety and the environment.

The capsules, which develop from the female flowers, usually contain three seeds each.

The seed may be egg shaped, oblong, or round. It usually has a prominent enlargement, the caruncle, on one end.

Seed of commercial varieties contain 40 to 55 percent of oil.

POISONOUS PROPERTIES

Castorbeans are poisonous. Eating only one seed may be fatal. Consult a physician immediately if any of the seed is eaten accidentally.

Follow these precautions in production and handling of castorbeans:

- Keep children away from castorbean fields and storage areas, and inform adults of the poisonous properties of castorbeans.
- Guard against the contamination of food and livestock feed with castorbean seeds.
- Warn truckers and others who haul castorbean seed that the seed is poisonous. Be sure they do not allow seed to spill on roads or streets, where it may be found by children.
- Clean all equipment in which castorbeans have been hauled before you use the equipment for other agricultural products.

The castorbean seed also contains a substance that causes allergy in some persons. Allergic reactions have been caused by inhaling dust from castorbeans or from using fertilizer made from castorbean pomace. Some persons who are prone to allergies have had allergic reactions from handling castorbeans.

The leaves contain a poison similar to that in the seed, but in much lesser quantities. Young leaves contain more poison than old leaves. The poison in the leaves could be harmful to livestock, but livestock do not eat castorbean foliage unless forced to by lack of other feed.

VARIETIES

Commercial castorbean varieties grown in the U.S. have been developed to give large yields of seed with a single harvest.

Both hybrid and inbred varieties are grown commercially. Some of the varieties have normal internodes and some have dwarf internodes. The hybrid varieties are comparable with hybrid varieties of corn. The dwarf-internode varieties are comparable with dwarf sorghum.

Six varieties are grown for commercial production in the United States: Pacific Hybrid 6, Hybrid 415, Baker Hybrid 45, Baker 296, Dawn, and Cimarron.

Pacific Hybrid 6, *Hybrid 415*, and *Baker Hybrid 45* are grown under irrigation in Arizona and California. They are similar in plant characteristics; they have few branches and long spikes. They usually flower at the

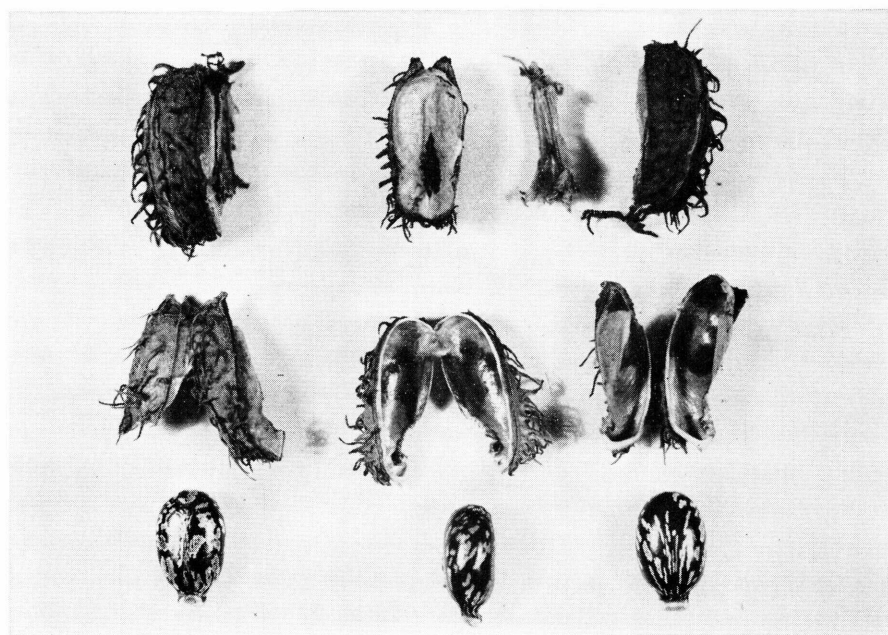
seventh, eighth, or ninth node and average about 7½ feet in height.

These hybrid plants are predominantly female. They usually are pollinated by one of the parents used in developing the hybrid. These pollen producers are planted with the hybrids.

Seed of these hybrids is available from castorbean processing firms. Like seed from hybrid corn, seed from hybrid castorbeans should not be planted; the resulting plants would be mixed in type and would not have the characteristics of the hybrid.

Under reasonably satisfactory conditions of moisture, temperature, and soil, yields of 2,500 pounds per acre or more are obtained from these hybrids. Oil content of the seed varies from 50 to 55 percent.

Baker 296 and *Dawn* are dwarf-internode inbred varieties that are grown on irrigated land in the High Plains area of Texas and New Mexico.



Capsule segments, hulls, and seeds. About natural size.

BN-10473

In the High Plains area, loss of seed from strong winds has been a problem. Because the plants are short—3 to 4 feet—Baker 296 and Dawn withstand strong winds better than normal-internode varieties.

Dwarf-internode inbred varieties yield less than normal-internode hybrids, so they are grown only where wind tolerance is a decisive factor.

Hybrid dwarf-internode varieties are now (1960) under development. These dwarf hybrids are expected to yield well enough to replace normal-internode hybrid varieties.

Cimarron is an inbred variety that has been grown as a nonirrigated crop in Oklahoma, Tennessee, Arkansas, and Mississippi. Over a number of years it has yielded better than other varieties in these States. It is resistant to bacterial and Alternaria leaf spot. It flowers at the tenth, eleventh, or twelfth node, branches more than the normal-internode hybrids, and does not grow as tall as they do. Because of the decrease in nonirrigated production, the supply of planting seed for *Cimarron* is limited.

CROP REQUIREMENTS

Castorbeans grow in temperate and tropical regions throughout the world. The area of successful commercial production, however, is limited by soil type, length of growing season, temperature during the growing season, soil-moisture supply, and humidity.

Soil for castorbeans should be fertile and well drained and should warm up quickly in the spring. Castorbeans do not grow well on soils of low fertility or on highly saline soils. They should not be planted on soils that are subject to erosion; the plants have little soil-binding ability.

A growing season of 140 to 180 days from the planting date is required to produce a satisfactory yield.

The crop does best where temperatures are fairly high throughout the

growing season. But if the temperature stays above 100° for an extended period, or if the soil moisture supply is inadequate, the seed may fail to set.

Irrigated crops need 2 to 3½ acre-feet of water during the growing season to produce satisfactory yields.

Though castorbeans need a generous supply of soil moisture, they are harmed by high humidity, which contributes to development of capsule and foliage diseases. These diseases have excluded the Eastern U.S. from commercial castorbean production.

Dampness also may hamper efficient harvest. Castorbean hulls absorb moisture readily. For efficient harvest with mechanical equipment, the seed capsules must be dry enough to be shaken from the plants.

GROWING THE CROP

Seedbed Preparation

Proper seedbed preparation is important for castorbeans. The seed needs an ample supply of soil moisture at planting depth for efficient germination.

To prepare the seedbed, plow, disk, or chisel the land, then ridge it. Run irrigation water into the furrows long enough to subirrigate through the ridges. In planting, enough dry soil will be removed from the ridges to allow the seed to be planted in undisturbed moist soil.

Planting

Before planting, treat seed to prevent damping-off of seedlings. Use seed-treating materials and practices that are used for other row crops.

Plant castorbeans as soon as possible after the soil warms. The soil temperature at a depth of 6 inches should be at least 60° at 8 a.m. for 5 consecutive days. The processor's field representative will tell you when to plant.

The row width depends on the row width of the harvester. Ask the field representative how far apart to make the rows. Castorbeans usually are planted in rows 38 inches apart in Arizona and California and in rows 40 inches apart in the High Plains area of Texas and New Mexico.

For recommended rate of planting, consult your seed distributor.

Planting Machinery.—Castorbean seed is easily broken; use an inclined-plate planter box or another type of planter box designed to prevent seed breakage.

To adapt planter boxes with horizontal plates for seeding castorbeans, replace the metal cutoff pawl with a nylon brush.

Newer horizontal-plate boxes have large plates with as many as 32 cells. The plates turn slowly and cause less damage to the castorbean seeds than do small, fast-turning plates.

To avoid seed damage when using conventional planter boxes with small plates, operate the planter at a speed under 3 miles per hour.

To prevent gumming of plates from cracked seed, add a handful of cornmeal or some cheap talcum to each hopper of seed.

Planting Depth.—Plant castorbean seed $1\frac{1}{2}$ to 3 inches deep in moist soil. To do this, allow the furrows to dry after irrigation, then remove dry soil from the tops of the ridges. Equip the planter with sweeps or middle busters to top the ridges.

With early planting, a depth of $1\frac{1}{2}$ inches is usually enough to keep the soil moist around the seed if the soil is well firmed over the seed with an open press wheel. Do not use press wheels if the soil is unusually heavy. Instead, plant to a depth of at least $2\frac{1}{2}$ inches.

Where strong, drying winds are expected, pack the planted rows after the top one-half inch of soil has dried.

Cultivating

Castorbeans are not strong competitors against weeds. They should be cultivated regularly the first few weeks after planting.

To break soil crusts and control weeds before the plants emerge, use either a light harrow or a rotary hoe. If you use a harrow, stop cultivating when the seedlings reach the stage where the crook is near the soil surface. You can determine this stage by uncovering several of the seedlings before cultivating.

After the plants have emerged, cultivate with a rotary hoe. Use the rotary hoe either as a unit that covers the entire soil surface or as a row attachment with the conventional row-crop cultivator. *Cultivation should be shallow*; the main lateral roots of the plant are near the soil surface.

Stop using the rotary hoe when it begins breaking the plants. Thereafter, use a row cultivator whenever necessary to control weeds.

Fertilizing

Fertilizer needs of castorbeans vary with locality. For specific recommendations consult your county agricultural agent or the field representative of the processing firm with which you have a marketing contract.

Generally, the crop needs 40 to 120 pounds of nitrogen per acre. If nitrogen is needed in large quantities, it may be supplied in split applications during the growing season. The various forms of nitrogen seem to be equally effective for castorbeans.

Follow nitrogen recommendations closely. Insufficient nitrogen results in reduced castorbean yields. If the plants begin to turn yellow during the growing season, apply nitrogen immediately. Excessive nitrogen is wasted; it promotes vegetative growth with little or no increase in seed yield.



First irrigation of castorbeans. (Courtesy of Baker Castor Oil Company.)

Phosphate may depress castorbean yields. It should be applied only where it is known to be needed for other crops.

Irrigating

Apply $2\frac{1}{2}$ to $3\frac{1}{2}$ acre-feet of irrigation water during the growing season. Usually castorbeans are furrow irrigated, but they are also well adapted for subirrigation. They develop a deep root system where sub-irrigation is practiced.

Irrigation usually begins when the plants are in the six- to eight-leaf stage and ends 2 to 4 weeks before harvest. Frequency of irrigation depends on the

needs of the plants; they may need water as often as once a week or as infrequently as once every 3 weeks.

When irrigation is frequent, watch for development of capsule mold. If you notice capsule mold irrigate less frequently.

With either furrow irrigation or sub-irrigation, overwatering should be avoided. Too much water can result in leaf wilting just as too little water can. This is especially noticeable during the early stage of development of the first spike. To avoid overwatering at the first irrigation, irrigate alternate rows.

Do not let plants go so long without water that the leaves wilt during the

morning hours. If irrigation water is limited, irrigate alternate rows throughout the season.

Harvesting

The processor's field representative will make arrangements for harvesting your castorbean crop.

Specially constructed harvesters and modified grain combines are available

to remove the capsules from standing plants and to hull and clean the seed. These machines can be used economically only if 400 acres or more of high-quality castorbeans are to be harvested.

At the end of the growing season, the castorbean field usually contains spikes in all stages of development; some have mature capsules, some have green capsules, and others may still be in bloom.



Hybrid castorbeans about 60 days after planting. A head ditch has been prepared and the rows furrowed out for the next irrigation. (Courtesy of Baker Castor Oil Company.)



BN-10471

Harvesting dwarf-internode castorbeans. The harvester has removed the capsules from the stalks on the right.

The crop is not ready for mechanical harvest until all the capsules are dry and the leaves have fallen from the plants. Either frost or chemical defoliant will put the plants in proper condition for harvesting.

Chemical defoliant permit control of the harvesting date. If killing frosts do not occur soon enough in the fall to permit completion of harvest before winter weather begins, use a chemical defoliant.

Apply the defoliant—either dinitro general in weed oil or pentachlorophenol in weed oil—10 to 15 days before harvest.

Chemical defoliant usually are applied by airplane.

PREPARING FOR NEXT CROP

Castorbean stalks and seed hulls, left in the field after harvest, are valuable additions to the soil. The stalks deteriorate rapidly and furnish organic matter to the soil. The hulls, which are scattered over the field dur-

ing harvest, are about equal to barnyard manure in fertilizing value.

After harvest, break up the stalks with mechanical stalk cutters. Disk the broken stalks and the seed hulls lightly into the soil.

Seed left in the field after harvest may cause a volunteer problem in crops that follow castorbeans. To reduce the likelihood that this will happen, irrigate the disked field to promote germination of the seed, then kill the young plants by disking them down.

Deeply buried seed may not germinate until the summer after harvest. Because of this castorbeans should not be followed by a crop in which the volunteer castorbean plants present any danger. Pasture or hay crops, for instance, should not follow castorbeans. Although livestock ordinarily do not eat castorbean foliage unless starved to it, they may accidentally eat it if it is mixed with desirable forage plants.

A good plan is to follow castorbeans with a row crop or a grain crop.

If a row crop follows castorbeans, volunteer castorbean plants can be killed by cultivating. Castorbean plants do not survive if they are cut off below the lowest node, usually an inch or two above the soil.

If a grain crop follows castorbeans, volunteer plants can be killed with 2,4-D. Remove by hand all castorbean plants that are not killed by 2,4-D. If any castorbean seed is found in the threshed sample of grain, all the grain can be condemned.

INSECTS AND DISEASES

Cutworms and wire worms may reduce castorbean stands. Stink bugs and the corn earworm cause occasional damage. In the High Plains of Texas the false chinch bug attacks the plants. For control recommendations consult your county agricultural agent, your State agricultural experiment station, or the processor's field representative.

Leaf- and stem-feeding insects usually do not cause serious damage. Stems and foliage are attacked by webworms, caterpillars, grasshoppers, thrips, spider mites, leaf miners, lygus bugs, the yellow-striped armyworm, and the European corn borer.

Though insects have not been a serious threat to castorbean production, the insect population may build up as

castorbean acreages increase. More control measures then will be necessary.

Diseases generally are not a major problem in areas where castorbeans are now produced. During periods of heavy rains or dews, however, capsule molds, *Alternaria* leaf spot, and bacterial leaf spot may occur and at times may be serious. These diseases make castorbean production impracticable in the South, except for drier parts of Texas and Oklahoma.

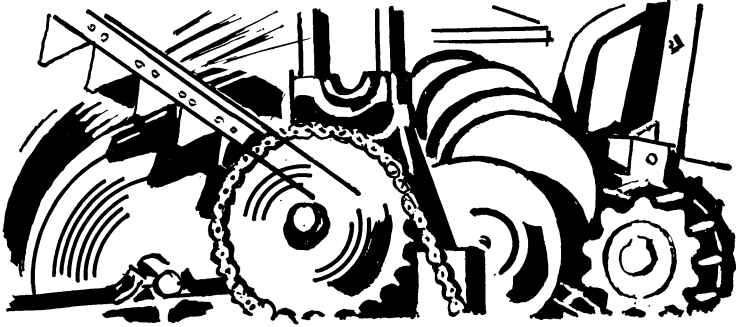
Some varieties are more resistant to diseases than others. As new disease-resistant varieties are developed, the area of commercial castorbean production may extend into the humid parts of the South.

The severity of some diseases can be decreased by changes in cultural practices. *Alternaria* leaf spot, for instance, is less severe in plants that have received an ample supply of nitrogen than it is in nitrogen-starved plants.

Cotton root rot, which also attacks castorbeans, can be prevented by planting castorbeans in fields where the disease has not occurred.

Seed rot can be controlled by treating the seed with a fungicide before planting.

If insects or diseases become troublesome, ask your county agricultural agent or the processor's field representative for control information.



Don't take chances with FARM MACHINES

- Keep guards in place on power shafts, belts, and chains.
- Turn off power and block the machinery before unclogging or adjusting it.
- Don't climb over or around a running combine or thresher.
- Don't step over or under moving belts.
- Don't wear loose-fitting or torn clothing, or ragged gloves around moving machinery.
- Keep children away from machinery.
- Keep machinery in good repair.

Farm Machines will save you time . . .

If you use them the safe way